Sudden Death in Sleep of Laotian-Hmong Refugees in Thailand: A Case-Control Study

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Abstract: A syndrome of sudden and unexpected death during sleep occurs among adult Southeast Asian refugees in the United States. Surveillance for sudden deaths was conducted among Laotian-Hmong refugees in the Ban Vinai refugee camp in northeastern Thailand to determine if a similar cause of death occurs there. Sixteen sudden and unexpected deaths associated with sleep were found that were similar to the sudden deaths noted among Southeast Asian refugees in the United States. A case-control study in Ban Vinai revealed associations between sudden death in sleep and membership in the Green-Hmong subgroup, a family history of sudden death, and previous non-fatal sleep disturbances.

Sudden and unexpected death during sleep of young adults is a regional phenomenon within Asia and occurs in populations that are culturally and genetically distinct. Migrants from affected populations in Asia carry with them the susceptibility to sudden death in sleep. (*Am J Public Health* 1987; 77:1187–1190.)

Introduction

A striking pattern of sudden and unexpected death during sleep occurs among Southeast Asian refugees in the United States.[1–10] The victims are predominantly young men, all in apparent good health, who die within minutes of the onset of agonal respirations during sleep. The proximate cause of death appears to be ventricular fibrillation in the absence of known cardiovascular disease.[9]

During 1981–82, the annual rate of sudden death of Southeast Asian refugee men, ages 25–44 years, in the United States was remarkably high: 92/100,000 among Laotian-Hmong, 82/100,000 among other Laotian ethnic groups (Lao, Mien-Yao, and Khmu) and 59/100,000 among Cambodians.[6] Similar deaths have been reported to occur among Vietnamese refugees in the United States. The rate cited for Laotian-Hmong men is equivalent to the sum of the rates of the leading five causes of natural death among US men of the same group. This high death rate may be why the pattern of Asian sudden deaths was recognized in the US.

A similar pattern of sudden death has been reported in other Asian populations including Filipinos in the Philippines,[11] United States,[12,13] and Guam,[14] Japanese in Japan,[15–17] natives of Guam,[14] and Chinese immigrants in the Philippines.[18] Sudden and unexpected deaths during sleep of young adults are known in the Philippines as *bangungut* ("to rise and moan in sleep") and were first described in the medical literature there in 1917.[11] The Honolulu Medical Examiner reported in 1948 a series of 81 similar deaths of Filipino men in Oahu County in the period 1937–48.[12] Similar deaths are known in Japan as *pokkuri* ("sudden and unexpectedly ceased phenomena") and were reported as early as 1959.[15] The Tokyo Medical Examiner recently reported that every year several hundred apparently healthy men are found dead in bed in the Tokyo District alone.[16] These observations suggest that the recent sudden deaths of Southeast Asian refugees in the United Staes are not a new phenomenon, but rather are a continuation of a pattern of sudden deaths that occur in mainland Southeast Asia. An investigation of sudden deaths among Laotian-Hmong refugees in Thailand was conducted to evaluate this hypothesis and to identify factors associated with this type of death.

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Methods

The Laotian-Hmong were chosen for study because they have one of the highest rates of sudden death in sleep of any of the groups of Southeast Asian refugees in the United States.[6] The Hmong have traditionally lived in Southern China and the highlands of North Vietnam, Laos, and Thailand. They are one of several ethnic groups that fled Laos as refugees after 1975. The investigation of sudden deaths reported here was conducted among Laotian-Hmong refugees in the Ban Vinai refugee camp in Thailand between October 1982 and June 1983. Ban Vinai is located in Loei province, 15 km from the Lao border, and is administered by the Thai Ministry of Interior and the United Nations High Command for Refugees (UNHCR). Ban Vinai was selected as the study site because it held the largest Hmong refugee population in Thailand, estimated at 33,000 in 1982.[19]

Most deaths in Ban Vinai occur outside the hospital and written death records are rarely completed. In the event of a death in the hospital, clinical records and a death certificate are not usually filed permanently. Autopsies are not performed because of the proscriptions of Hmong religious beliefs. Because of these limitations, ethnographic study of the Hmong in Ban Vinai was important and provided information on Hmong culture and social structure that aided the epidemiologic investigations.

A surveillance network was organized through clan and community leaders in Ban Vinai. Information was sought on any case of sudden natural death, defined as a death that occurred within 24 hours of the onset of acute signs or symptoms to a previously healthy individual. An interview was arranged with the next of kin who lived with the victim and either witnessed the death or found the body. The interviews were conducted by the author in the informants' homes with the aid of a trained Hmong interpreter. The interviews were initially open-ended, with the informant describing how the death occurred and events considered relevant to the death. A structured interview was then conducted to collect further information on circumstances of the death, illness history, demographic background, and history of sleep disturbances. A genealogy was constructed that included all relatives known by the informant. The vital status and circumstances of death of all relatives in the genealogy were noted. The reliability of reports of sudden death was assessed by a second interviewer (E. A. Booton, RNC) who re-interviewed the informants with a different interpreter. Both were unaware of the results of the initial interview.

A case-control study was conducted with cases defined as confirmed sudden and unexpected deaths that were associated with sleep and occurred in a Thai refugee camp. Cases were limited to deaths that occurred while the victim was in bed, thus the victim may have been falling asleep, sleeping, or awakening. Deaths after sudden collapse of individuals who were awake and out of bed were investigated, but not included in the case-control study. This narrow case definition was used because observations in the US indicated that Southeast Asian sudden deaths appeared to be associated with sleep.

The control-subjects were randomly selected from the list maintained by the UNHCR of all Hmong refugees in Ban Vinai and were matched to cases by age (±three years) and sex. A relative who lived with the control-subject was interviewed so that data on both cases and controls were reported by relatives and thus were more comparable. An attempt was made to select an informant whose relationship to the control-subject was identical to that of the case-informant and the matched case-subject. A genealogy was also constructed for each control-subject.

Results

Twenty-seven deaths were investigated in Ban Vinai. Sixteen of the deaths were determined to be sudden, unexpected, associated with sleep, and occurred in individuals who were previously healthy. These 16 were included as cases in the case-control study. The deaths were distributed by year as follows: 1979 (1), 1980 (2), 1981 (7), 1982 (5), and 1983 (1). Fourteen of the deaths of cases occurred in Ban Vinai. The other two case-deaths occurred in the nearby Nong Khai refugee camp, and the surviving relatives moved to Ban Vinai. Eleven deaths were excluded from the case-control study because it was determined upon interview that serious illness preceded death by more than 24 hours (5), the death was not associated with sleep (4), or a reliable informant was not available (2).

The cases included 12 men and four women with a median age of 33 years. The controls included 12 men and four women with a median age of 32.5 years. The relationships between informants and subjects were identically matched in 13 case-control pairs. The three exceptions included the following case-control pairs of informants: son/brother, father/brother, and first-cousin/aunt.

In three cases the victims were found dead in bed and had apparently died during sleep. In the 13 witnessed cases, the deaths occurred in bed after the witnesses were alerted by agonal respirations and found the victim unresponsive. None of the witnesses reported tonic-clonic movements although tonic rigidity of the limbs and jaw, cyanosis, excessive salivation, and incontinence were reported in several cases. Of the witnessed deaths, nine occurred within 10 minutes and three within 30 minutes after the onset of acute signs; the remaining witnessed death occurred outside the refugee camp, one to two hours after the onset of acute signs, while the victim was being transported to a Thai hospital.

Both cases and controls were similar in their occupational background, military experience, provinces of birth and residence, and median month of arrival in Thailand (Table 1). The median length of residence in Thai refugee camps was less for cases (entry until death) than for controls (entry until interview). Seven of the 16 cases and one of the 16 controls belonged to the Green-Hmong subgroup. The remaining cases and controls were members of the White-Hmong subgroup (odds ratio = 7.0; 95 per cent CI: 1.1, 166 for matched data).

TABLE 1—Characteristics of Cases and Controls in the Ban Vinai Study

	Cases	Controls
Men/women	12/4	12/4
Median age (years)	33	32.5
Date entered Thailand (median)	September 1979	December 1979
Length of residence in Thai refugee camps (mean months, 95% CI)	23.5 (14.7–32.3)	51.0 (39.9–62.1)
Employed as farmer in Laos	12	12
Military experience	10	7
Green/White Hmong*	7/9	1/15
Sleep disturbances	4	0
Sudden deaths among relatives:		
Relationship	deaths/relatives ascertained	deaths/relatives ascertained
Sibling	1/89	0/87
Son or daughter	1/60	0/61
Niece or nephew	1/119	0/150
First cousin	2/88	0/205
Total	5/356	0/503

*odds ratio = 7.0, 95% CI: 1.1, 166 (matched data)

Additional sudden deaths associated with sleep had occurred among relatives of the cases, but none were found among the relatives of controls. Sudden deaths of relatives are reported here only if they were associated with sleep, the victim was previously healthy, and the death was verified by a witness or, in the case of a death in the US, review of the autopsy report. Five additional sudden deaths meeting these criteria were found among the 356 biological relatives, listed in Table 1, of the 16 index cases. No similar deaths were found among the 503 relatives of the same degree of the controls.

- An 18 year-old nephew and a 15 year-old daughter of index Case 1 died suddenly in sleep. The nephew died in Ban Vinai, was identified separately via the surveillance network, and is included as an index case. The daughter died during a daytime nap in Laos.
- A two-month old infant boy, the first cousin of index Case 2, was found dead in bed in Laos.
- A 20 year-old male first cousin and an 18 year-old brother of index case 3 also died suddenly. The cousin awoke, complained of dizziness, and collapsed immediately in bed. The brother died in California in 1982 and an autopsy was performed. The death certificate and autopsy report were reviewed and the death was confirmed as sudden, unexplained and occurring during sleep. The death in California was included among the cases of Southeast Asian sudden deaths reported in the US by the Centers for Disease Control.

Non-fatal sleep disturbances had previously occurred in four of the cases. Sleep disturbances were defined as transient episodes of distress and unresponsiveness that began abruptly with abnormal respirations. The abnormal respirations were described as gasping and groaning sounds, distinct from normal snoring, and similar to the agonal respirations that preceded sudden death in sleep. None of the controls had experienced similar sleep disturbances.

- The wife of 39 year-old Case 4 found him unresponsive after she was awakened by his abnormal respiratory sounds at midnight. He regained consciousness after five minutes of vigorous massage given by his wife and described having had the sensation of airway obstruction. He returned to sleep, awoke at 7:00 am, but remained in bed. The subject then

complained of chest discomfort, collapsed, and died suddenly in bed.

- Case 5, a 40 year-old man, was found dead in bed. He had experienced sleep disturbances four to six times a year during the three years before his death in 1981. His wife was often awakened by his abnormal respirations. When aroused from these episodes, he reported a sensation of chest pressure that made breathing difficult.
- The parents of Case 2 became alarmed when they were awakened at 10:00 pm by her abnormal respirations and found her unresponsive in bed. They recognized the episode as similar to others reported by relatives and neighbors, and administered vigorous massage and acupuncture to arouse her. She regained consciousness after several minutes. The girl died suddenly in sleep 33 months later at the age of 18. Her parents witnessed the fatal episode and described the agonal signs as identical to the signs of distress in the previous episode.
- The father of Case 6 was awakened near midnight by the abnormal respirations of his 25 year-old son. The son was awakened without great difficulty, but was alarmed by the sensation of numbness and weakness of his legs. The young man went to the camp hospital the next morning and returned home after a normal examination. He died suddenly during a nap at 2:00 pm the same day.

Discussion

The sudden and unexplained deaths of Southeast Asian refugees in the United States are part of a distinct syndrome that occurs in several Asian populations. A similar pattern of sudden death was found among Laotian-Hmong refugees in Thailand and is described in this report.

The Asian sudden death syndrome is different from major patterns of sudden death known in Western populations. Among adults in the West, sudden death is strongly associated with atherosclerotic heart disease, is not associated with sleep, and is more likely to occur with increasing age.[20–23]

Autopsies would strengthen the investigation of sudden deaths in Ban Vinai, but are difficult to obtain, given the proscription of Hmong religious beliefs, the shortage of medical facilities, and lack of medical-legal statutes. The Southeast Asian victims of sudden death studied at autopsy in the US were remarkable in their absence of cardiovascular disease. Coronary atherosclerosis was absent or minimal in 45 of 49 cases reviewed in the United States; two cases included moderate coronary atherosclerosis (25–50 per cent narrowing), two others included more advanced atherosclerosis (>50 per cent narrowing), but none showed evidence of acute coronary thrombosis or myocardial infarction.[6] Atherosclerotic heart disease is unlikely to play a significant role in deaths occurring under similar circumstances in Thailand. In a recent, unblinded review of the cardiac pathology of 18 Southeast Asian victims of sudden death in the US, cardiomegaly and conduction system anomalies were noted, although no controls were used in this study.[24] An autopsy would be critical in the judgment of cause or lack of cause in any individual case, but autopsies are not required to identify an overall pattern of sudden deaths associated with sleep in this refugee camp. Because autopsies were not available, a conservative case definition was used, limited to deaths associated with sleep. Four deaths after sudden collapse of individuals who were awake and out of bed were excluded, although these may have been related to the deaths in sleep.

The comparisons of cases and controls were not confounded by differences in age, gender, their relationships to informants, occupational background, military experience, and provinces of birth and residence. The controls had lived longer in the camp at the time of interview than the cases had at the time of their death. The median month of migration to Thailand was similar in both groups, indicating that cases and controls were selected from similar stages of migration and that the difference in length of residence is a result of the retrospective nature of this study. Southeast Asian victims of sudden death in the US tend to be more recent immigrants, compared to controls,[6] indicating that newly arrived refugees in the US may have a greater risk of sudden death than longer-term residents of the same group.

The average age of adult victims of sudden and unexplained death in sleep is between 30–34 years in the Ban Vinai study, a more recent series of refugee deaths in Thailand,[25] and three other Asian populations (Table 2). It is not clear whether this indicates similar age-specific death rates among them because the age distributions are not known for all of these populations. Further studies of sudden death in sleep in these populations should test the hypothesis that this syndrome is characterized by a unique distribution of death rates by age, with men in their early thirties having the greatest risk of death.

The Asian sudden deaths occur predominantly, but not exclusively, among men. The 79 sudden deaths reported among Southeast Asians in the United States included one woman.[6] The 16 Ban Vinai cases included four women, one 39 years old and three in their teens: 13, 15, and 18 years old. Three of these four women were members of the Green-Hmong subgroup, shown to have a greater risk of sudden death than other Hmong. Further study is needed to determine whether refugee women in Thailand have an elevated risk of sudden death compared to refugee women in the United States.

Members of the Green-Hmong subgroup were found in a previous US study to have an excess risk of sudden death compared to members of the White-Hmong subgroup.[4] This association was also found among Laotian-Hmong refugees in Ban Vinai. The White and Green-Hmong are distinguished by differences in dialect, ritual, clothing and music, as well as differences in political dominance and socioeconomic status. Hmong tend to marry and interact within their own subgroup. Other Hmong subgroups exist in Southeast Asia and southern China, but were not found in the Ban Vinai sample. The reason for the increased risk of sudden death among Green-

TABLE 2—Age and Sex of Victims of Sudden and Unexplained Death during Sleep in Four Asian Populations

Population	Sample Size	Average Age (years)	Age Range (years)	% Male
Filipinos in Hawaii[12]	81	30–34*	20–60	100
Japanese in Japan[15]	76	31.4**	18–48	100
SE Asian refugees in the US[6]	79	33†	16–63	99
Laotian-Hmong refugees in Thailand (this report)	16	33**	13–60	75
Laotian-Hmong, Lao, Cambodian, Mien-Yao refugees in Thailand[25]	19	34**	20–60	100

*median group
**mean
†median

Hmong is unknown and this group should be the focus of further study.

Certain families in Ban Vinai have an elevated, although unspecified, risk of sudden death compared to others of the same ethnic group. A bias favoring greater recollection of similar deaths in families of the deceased is a pitfall of case-control studies. The genealogical studies should have reduced this bias; all deaths were listed in case and control families, and the circumstances of each death were reviewed. This familial association was not confounded by Green-Hmong affiliation as all index cases with a positive family history of sudden death in sleep were members of the White-Hmong subgroup. Family size and structure also differed between cases and controls. The controls had larger extended families than cases (Table 1), an important determinant of social and economic status in the camp. The finding of clusters of sudden deaths within families could reflect environmental or genetic factors common to these families. Family clusters of sudden death were not detected in a case-control study in the US, although thorough genealogical interviews were not employed.[6] Two case-studies in the US did report family clusters of sudden deaths, but did not include study of controls.[4,7] Many refugee families have relatives living in Thai refugee camps, non-refugee Thai-Hmong villages, and the United States, a situation that provides opportunities for the study of the aggregation of sudden deaths in families spanning very different environments.

Southeast Asian refugees with a history of seizure-like episodes in sleep may have an elevated risk of sudden death. Sleep disturbances similar to those reported in Ban Vinai have also been described elsewhere as occurring to refugees who later died suddenly in sleep.[9,10,25] Southeast Asian refugees who experience these episodes should be placed under the observation of medical personnel with advanced cardiopulmonary resuscitation (CPR) equipment.

The Asian sudden death syndrome may be a useful model for the study of cardiac arrhythmias and sleep disorders in the absence of atherosclerotic heart disease. This syndrome appears to be a regional phenomenon and occurs in Asian populations that are culturally and genetically distinct. More recent surveillance of deaths in refugee camps in Thailand has provided evidence that the rate of sudden death associated with sleep is even greater among refugees in Thailand than among this group in the United States.[25] Migrants from affected Asian populations appear to carry with them the susceptibility to sudden death in sleep. Further study among refugees is needed in both Thailand and the US to better evaluate sudden death rates and the environmental factors in the camps related to the risk of these tragic and premature deaths.

ACKNOWLEDGMENTS

Marshall G. Hurlich, PhD, inspired and guided this work. Elizabeth A. Booton, RNC, Vang Lia, and Mai Lee Lor assisted in the fieldwork in Ban Vinai. The Thai National Research Council, Thai Ministry of the Interior, Christian and Missionary Alliance, ZOA-Dutch Refugee Relief, the Intergovernmental Committee for Migration, the International Rescue Committee, United Nations High Command for Refugees, and the Hmong communities in Thailand and the United States kindly provided assistance. Drs. Ronald Prineas, Noel Weiss, and Joseph Westermeyer provided helpful comments on the manuscript.

Portions of this paper were presented at the Symposium on Human Biology and Epidemiology, Society for Epidemiological Research, June 14, 1984, in Houston, Texas, and the Xth meeting of the International Epidemiological Association, August 20, 1984, in Vancouver, British Columbia. This work was supported in part by the Research and Travel Fund of the Graduate School, University of Washington, the Intergovernmental Committee for Migration, and NIH grants BRSG-507RR-05548 and RO1-HL-19877 to the University of Minnesota School of Public Health.

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